

epoxy system  
adhesive

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-199145

(43)Date of publication of application : 31.07.1997

(51)Int.Cl.

H01M 8/02

H01M 8/10

(21)Application number : 08-028661

(71)Applicant : TOYOTA MOTOR CORP

(22)Date of filing : 22.01.1996

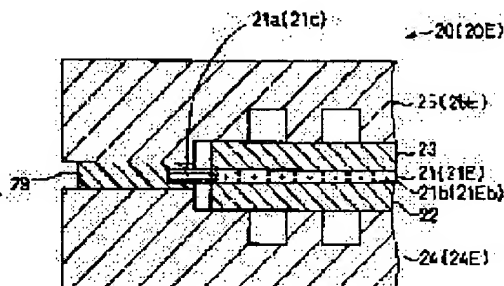
(72)Inventor : KAWAHARA TATSUYA

## (54) FUEL CELL AND MANUFACTURE OF FUEL CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To make sufficient gas sealability of a solid high polymer electrolyte fuel cell without obstructing the thinning by suppressing an electrolyte film amount to a minimum.

SOLUTION: In an electrolyte film 21, an ion exchange part 21a is formed in a peripheral part corresponding to a connection part with separators 24, 25. The ion exchange part 21a, after mounting a prescribed masking implement on the electrolyte film 21, is formed by immersing it in a potassium hydroxide solution of 1 normal. A battery operating part 21b covered with the masking implement, because of not receiving ion exchange treating, function as an electrolyte layer. The ion exchange part 21a, receiving the ion exchange treating, generates a hydrophobic property, a water absorptive property is lost. In this ion exchange part 21a losing the water absorptive property, a bonding agent is used, the electrolyte film 21 is secured to the separators 24, 25.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C), 1998,2000 Japanese Patent Office

\* NOTICES \*

The Japanese Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] It is the fuel cell which is a fuel cell using the solid-state poly membrane as an electrolyte layer, and the above-mentioned solid-state poly membrane forms the active region which has cation-exchange activity, and the inactive field which does not have cation-exchange activity, and comes to fix the above-mentioned solid-state poly membrane in a frame in this inactive field.

[Claim 2] It is the fuel cell according to claim 1 which is what the above-mentioned inactive field is a field which wore the hydrophobic property, and depends fixing to the frame of the above-mentioned solid-state poly membrane on the adhesion which used adhesives.

[Claim 3] It is the fuel cell according to claim 1 which is what the above-mentioned inactive field is a field tintured with the thermoplastic, and depends fixing to the frame of the above-mentioned solid-state poly membrane on thermocompression bonding.

[Claim 4] The claim 1 which is the separator with which the above-mentioned frame pinches the gas diffusion electrode prepared with the above-mentioned solid-state poly membrane, or a fuel cell given in three.

[Claim 5] The fuel cell according to claim 3 by which the field in connection with fixing with the above-mentioned solid-state poly membrane is split-face-ization-processed in the above-mentioned frame.

[Claim 6] It is the fuel cell which forms the inactive field equipped with the thermoplastic, without being the fuel cell using the solid-state poly membrane as an electrolyte layer, and the above-mentioned solid-state poly membrane having cation-exchange activity with the active region which has cation-exchange activity, and comes to fix the above-mentioned solid-state poly membrane by thermocompression bonding in a frame through the thin film which has the thermoplastic in this inactive field.

[Claim 7] The fuel cell according to claim 6 which is the thin film of the material as the inactive field in the above-mentioned solid-state poly membrane with the same thin film which has the above-mentioned thermoplastic.

[Claim 8] The inactive field of the above-mentioned solid-state poly membrane is a fuel cell the claim 1 which is the field which performed cation-exchange processing to the predetermined field of this solid-state poly membrane, or given in seven.

[Claim 9] The inactive field of the above-mentioned solid-state poly membrane is a fuel cell the claim 1 which is the field which made the property of this precursor layer hold, without only the predetermined field of this precursor layer performing this predetermined processing in case the precursor layer with this inactive solid-state poly membrane is activated by predetermined processing, or given in seven.

[Claim 10] The manufacture technique of the fuel cell which inactivates a part of electrolyte layer which consists of a solid-state poly membrane, forms the inactive field which does not have cation-exchange activity, and fixes the above-mentioned solid-state poly membrane in a frame in this inactive field.

[Claim 11] The manufacture technique of the fuel cell which fixes the above-mentioned solid-state poly membrane in a frame in the inactive field which remained, without activating the principal part of the inactive solid-state poly membrane which does not have cation-exchange activity, forming the electrolyte layer equipped with cation-exchange activity, and being activated in the case of the above-mentioned activation.

[Claim 12] By having cation-exchange activity, it is the solid-state poly membrane which can be used as an electrolyte layer, and this solid-state poly membrane forms the inactive field which does not have cation-exchange activity among the periphery section, sets it to this inactive field, and it is the solid-state poly membrane which can fix in a frame about the above-mentioned solid-state poly membrane.

---

[Translation done.]

## \* NOTICES \*

The Japanese Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

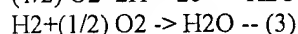
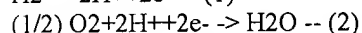
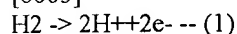
[0001]

[The technical field to which invention belongs] this invention relates to the manufacture technique of the fuel cell and fuel cell which were equipped with gas-seal structure between the frames which attach a solid-state polyelectrolyte layer and this in detail about a fuel cell.

[0002]

[Description of the Prior Art] The fuel cell is known as equipment which changes into electrical energy directly the energy which a propellant has. In a fuel cell, the fuel gas containing hydrogen is supplied to an anode, the oxidization gas containing oxygen is supplied to a cathode, and electromotive force is obtained according to the electrochemical reaction which happens on two poles. The electrochemical reaction which happens to below by the fuel cell is shown. (1) A reaction and (2) formulas show the reaction in a cathode, and (3) formulas express the reaction which happens by the whole cell. [ in an anode in a formula ]

[0003]



[0004] The general gestalt of such a fuel cell arranges the electrode of a couple on both sides of an electrolyte layer, and supplies the oxidization gas which contains oxygen in the electrode (cathode) of another side for the fuel gas which contains hydrogen in one electrode (anode). In such a fuel cell that receives supply of the oxidization gas containing the fuel gas containing hydrogen, and oxygen, when the gas supplied to each electrode is mixed, problems, such as a fall of a generating efficiency, arise. Therefore, it is required to prevent the mixture with fuel gas and oxidization gas in the fuel cell.

[0005] A solid-state macromolecule type fuel cell is a fuel cell equipped with a solid-state polyelectrolyte layer as an electrolyte layer. The single cell is made into the base unit and the stack structure which usually carried out the laminating of this single cell is taken. a single cell -- an electrolyte layer -- the gas diffusion electrode of two sheets -- pinching -- a sandwich structure -- forming -- this sandwich structure -- gas -- the separator [ \*\*\*\* / un- ] is pinching further The electrolyte layer has also played the role which separates the fuel gas supplied and oxidization gas, and it prevents gas mixing a separator between the adjoining single cells. Therefore, in order to prevent the mixture with fuel gas and oxidization gas by the solid-state macromolecule type fuel cell, it becomes important to fully secure the seal nature between an electrolyte layer and a separator in the circumference section of each \*\* cell.

[0006] Usually, although such seal nature is easily attained by pasting up using adhesives etc., the fluorine system resin used as a solid-state polyelectrolyte layer has a bad adhesive property over adhesives, and the adhesive property falls further in a damp or wet condition. Although an electrolyte layer is a hydrophilic layer and it is maintained at a damp or wet condition in response to supply of moisture at the time of an operation of a fuel cell, in such the status, an electrolyte layer will be swollen, the layer of water will be formed in a front face, and the adhesive property with adhesives will fall further. Therefore, only by pasting up an electrolyte layer and a separator with adhesives, the adhesive property of adhesives falls gradually working [ a cell ], and seal nature will be spoiled. Since adhesion sufficient between separators is not obtained even if a solid-state polyelectrolyte layer does not have the thermoplastic, therefore it performs thermocompression bonding as technique of attaining a good gas seal, although the method of sticking an electrolyte layer and a separator by thermocompression bonding is also considered, it is hard to adopt too.

[0007] Then, in order to attain the seal nature in the edge of a fuel cell conventionally, Mizobe was prepared in the separator edge, the seal between a separator and an electrolyte layer was realized by allotting this Mizobe an O ring, and mixture of the gas supplied to the both sides of an electrolyte layer was prevented (for example, JP, 6-119930, A etc.). By allotting such an O ring, the passage of fuel gas or oxidization gas could be completely intercepted with the exterior, and it was enabled to prevent mixture of hydrogen and oxygen.

[0008]

[Problem(s) to be Solved by the Invention] However, there is a trouble of barring a miniaturization and high increase in power of a fuel cell in the gas seal using the O ring. In order to attain a miniaturization of a fuel cell, it is necessary to thin-shape-ize each component of a fuel cell. If each component thin-shape-izes and a single cell becomes thin, it comes to be

able to carry out the laminating of more single cells in few space, and the high increase in power of a fuel cell can be attained. However, in allotting an O ring, from the need of preparing the slot for allotting an O ring, a limitation is to make a separator thin and it has barred thin shape-ization of a fuel cell as a result.

[0009] Moreover, in considering as the configuration which allots the above O rings, in order to secure the seal nature by the O ring, the area of a needed electrolyte layer will increase. It becomes the factor in which this also obstructs a miniaturization of a fuel cell. Since Mizobe who needs to prepare the electrolyte layer of sufficient size exceeding Mizobe who prepared in the separator in order to allot an O ring, and allots this O ring can seldom approach and prepare in a gas diffusion electrode when using an O ring, an electrolyte layer will require an area excessive in addition to a cell right hand side. Furthermore, the solid-state polyelectrolyte layer used now is very expensive, the rate for which it accounts to the cost of the whole fuel cell is also large, and it has been a serious failure to need a big electrolyte layer when putting a fuel cell in practical use widely.

[0010] Without having solved such a problem, having stopped required electrolyte \*\*\*\* to the minimum extent, and barring thin shape-ization of a fuel cell, the fuel cell of this invention is made for the purpose of realizing sufficient gas-seal nature between an electrolyte layer and a separator, and took the following configuration.

[0011]

[The means, and its operation and effect] for solving a technical problem The 1st fuel cell of this invention is a fuel cell which used the solid-state poly membrane as an electrolyte layer, and let it be a summary that the above-mentioned solid-state poly membrane forms the active region which has cation-exchange activity, and the inactive field which does not have cation-exchange activity, and comes to fix the above-mentioned solid-state poly membrane in a frame in this inactive field.

[0012] The active region which has the cation-exchange activity in the solid-state poly membrane with which this fuel cell is equipped commits the 1st fuel cell of this invention constituted as mentioned above as an electrolyte layer at the time of an operation of a fuel cell. Moreover, this solid-state poly membrane fixes in the frame in the inactive field which does not have cation-exchange activity.

[0013] In such a fuel cell, it has the inactive field for fixing a solid-state poly membrane in a frame out of the active region in connection with a cell reaction as an electrolyte layer in the solid-state poly membrane. Therefore, the gas seal between an electrolyte layer and a frame can be attained, without being able to fix an electrolyte layer in a frame and preparing a member like an O ring separately by this, without influencing a cell reaction. Since the thickness of an O ring is not applied like before by not using an O ring, the effect that a fuel cell can be thin-shape-ized is done so. Moreover, since the area-additional coverage which was required for the site which allots an O ring becomes unnecessary, the area of the solid-state poly membrane to prepare can be managed with the minimum.

[0014] The above-mentioned inactive field is a field which wore the hydrophobic property here, and fixing to the frame of the above-mentioned solid-state poly membrane is good also as a configuration which is what is depended on the adhesion which used adhesives.

[0015] In the configuration of the 1st fuel cell of this invention, the 2nd fuel cell of this invention constituted as mentioned above is the inactive field which wore the hydrophobic property, and fixes a solid-state poly membrane in a frame by adhesion using adhesives. In addition to the effect which the 1st fuel cell of this invention has, the following effects are done so in such a fuel cell. That is, even if the active region which is a cell right hand side absorbs water when adhesives are used for this inactive field since the inactive field wears the hydrophobic property, an inactive field does not absorb water and the adhesive property of adhesives does not fall. Therefore, adhesives can perform the gas seal between a solid-state poly membrane and a frame.

[0016] Moreover, in the 1st fuel cell of this invention, the above-mentioned inactive field is a field tintured with the thermoplastic, and fixing to the frame of the above-mentioned solid-state poly membrane is good also as a configuration which is what is depended on thermocompression bonding.

[0017] In the configuration of the 1st fuel cell of this invention, the 3rd fuel cell of this invention constituted as mentioned above is the inactive field tintured with the thermoplastic, and fixes a solid-state poly membrane in a frame by thermocompression bonding. In addition to the effect which the 1st fuel cell of this invention has, the following effects are done so in such a fuel cell. That is, since the inactive field takes on the thermoplastic, thermocompression bonding can perform the gas seal between a solid-state poly membrane and a frame.

[0018] In the 1st of the above-mentioned this invention, or the 3rd fuel cell, it is good also as being the separator with which the above-mentioned frame pinches the gas diffusion electrode prepared with the above-mentioned solid-state poly membrane. In such a fuel cell, the fuel gas and oxidization gas which are supplied to the gas diffusion electrode prepared in both sides of a solid-state poly membrane are divided by the solid-state poly membrane. Moreover, since a solid-state poly membrane fixes in a separator in an inactive field, the gas seal is attained in this field that fixes. Therefore, the gas seal between a solid-state poly membrane and a separator can be performed, without preparing members, such as an O ring, separately. Moreover, since it is not necessary to form Mizobe for allotting an O ring to a separator, forming this Mizobe does not bar thin shape-ization of a separator. When thin shape-ization of a separator is attained, thin shape-ization of the whole fuel cell is attained.

[0019] In the 3rd fuel cell of the above-mentioned this invention, the above-mentioned frame has the suitable field in connection with fixing with the above-mentioned solid-state poly membrane also for the configuration currently split-face--ization-processed. In case thermocompression bonding is performed between such a configuration then a solid-state poly membrane, and a frame, the inactive field of a solid-state poly membrane dissolves with heat, and the interior

of fine irregularity the frame front face was split-face--ization-processed is entered. The solid-state poly membrane which dissolved and entered the interior of concavo-convex is solidified with the configuration where the interior of concavo-convex was entered as it is cooled, since it has the thermoplastic. Therefore, the adhesion area by thermocompression bonding becomes large, and it can paste up more firmly.

[0020] The 4th fuel cell of this invention is a fuel cell which used the solid-state poly membrane as an electrolyte layer, and let it be a summary that the above-mentioned solid-state poly membrane forms the active region which has cation-exchange activity, and the inactive field equipped with the thermoplastic, without having cation-exchange activity, and comes to fix the above-mentioned solid-state poly membrane by thermocompression bonding in a frame in this inactive field through the thin film which has the thermoplastic.

[0021] The active region which has the cation-exchange activity in the solid-state poly membrane with which this fuel cell is equipped commits the 4th fuel cell of this invention constituted as mentioned above as an electrolyte layer at the time of an operation of a fuel cell. Moreover, this solid-state poly membrane fixes in the frame by thermocompression bonding through the thin film which similarly has the thermoplastic in the inactive field equipped with the thermoplastic, without having cation-exchange activity.

[0022] According to the 4th fuel cell of such this invention, when using a thin solid-state poly membrane in addition to the effect by the 3rd fuel cell of this invention, the effect of preventing a solid-state poly membrane receiving trauma at the time of thermocompression bonding is done so. That is, in case thermocompression bonding is performed between a solid-state poly membrane and a frame, in order to carry out through the thin film which has the thermoplastic as well as an inactive field, the fixing section becomes thick and the intensity of the part of a thin film to a pressure increases. Therefore, even if a solid-state poly membrane is thin, a solid-state poly membrane does not receive [ a high pressure ] trauma in thermocompression bonding in the fixing section by such thing. Furthermore, when the fixing section became thick and the intensity to a pressure increased, even if the strong pressure by bolting continues being applied on stream [ a fuel cell ], a solid-state poly membrane does not cause the shunt in response to trauma. Conversely, since trouble is lost to thermocompression bonding even if a solid-state poly membrane is thin, the 4th fuel cell of this invention does so the effect of enabling it to be able to raise the conductivity of an electrolyte layer by thin-shape-izing a solid-state poly membrane, and to raise a cell performance by this.

[0023] It is good also as being the thin film of the material as the inactive field in the above-mentioned solid-state poly membrane with the thin film same here which has the above-mentioned thermoplastic. In such a case, since an inactive field and a thin film are the same materials, when thermocompression bonding is performed, both do melting, unify easily and show the outstanding adhesive property.

[0024] It sets to the 1st of the above-mentioned this invention, or the 4th fuel cell, and the configuration of the inactive field of the above-mentioned solid-state poly membrane which is the field which performed cation-exchange processing to the predetermined field of this solid-state poly membrane is also desirable. In such a case, predetermined ion-exchange liquid can only be infiltrated into the predetermined field of a solid-state poly membrane, and the above-mentioned inactive field can be formed.

[0025] Moreover, in the 1st of the above-mentioned this invention, or the 4th fuel cell, the inactive field of the above-mentioned solid-state poly membrane is good also as being the field which made the property of this precursor layer hold, without only the predetermined field of this precursor layer performing this predetermined processing, in case the precursor layer with this inactive solid-state poly membrane is activated by predetermined processing. In such a case, in case the precursor layer of a solid-state poly membrane is activated, an inactive field can be formed, when only a predetermined field does not receive this activation processing and carries out it. Therefore, in order to form an inactive field, it is not necessary to add special processing to a solid-state poly membrane, and fixing with a frame can be performed using the property of the hydrophobic property or thermoplastic which a precursor layer has.

[0026] Let it be a summary that for the manufacture technique of the 1st fuel cell of this invention to form the inactive field which inactivates a part of electrolyte layer which consists of a solid-state poly membrane, and does not have cation-exchange activity, and fixes the above-mentioned solid-state poly membrane in a frame in this inactive field.

[0027] By the manufacture technique of the 1st fuel cell of this invention constituted as mentioned above, this solid-state poly membrane is fixed in a frame in the inactive field which inactivated a part of electrolyte layer which consists of a solid-state poly membrane. Therefore, in case a fuel cell is manufactured, in order to attain the seal nature of gas, it is not necessary to prepare members, such as an O ring, separately. According to such manufacture technique, a gas seal can be performed by fixing the inactive field and frame which were prepared in a part of electrolyte layer.

[0028] Moreover, let it be a summary that the manufacture technique of the 2nd fuel cell of this invention fixes the above-mentioned solid-state poly membrane in a frame in the inactive field which remained, without activating the principal part of the inactive solid-state poly membrane which does not have cation-exchange activity, forming the electrolyte layer equipped with cation-exchange activity, and being activated in the case of the above-mentioned activation.

[0029] By the manufacture technique of the 2nd fuel cell of this invention constituted as mentioned above, in case the inactive solid-state poly membrane which does not have cation-exchange activity is activated, in the inactive field which remained, without performing this activation, this solid-state poly membrane is fixed in a frame. Therefore, the effect that it is not necessary to perform special processing for forming the inactive field other than the effect in the manufacture technique of the 1st fuel cell of this invention is done so.

[0030] The solid-state poly membrane of this invention is equipped with cation-exchange activity, it is the solid-state poly

membrane which can be used as an electrolyte layer, and this solid-state poly membrane forms the inactive field which does not have cation-exchange activity among the periphery section, and let it be a summary to be able to fix the above-mentioned solid-state poly membrane in a frame in this inactive field.

[0031] Since the solid-state poly membrane of this invention constituted as mentioned above can be fixed in a frame by the inactive field established in the periphery section of a field which works as an electrolyte layer, it can manufacture the fuel cell which does not use another members, such as an O ring, by using this solid-state poly membrane.

[0032]

[Embodiments of the Invention] In order to clarify much more a configuration and an operation of this invention explained above, the gestalt of operation of this invention is explained below based on an example. The fuel cell 10 which is one suitable example of this invention makes the single cell 20 the base unit, and has the stack structure which carried out the laminating of the single cell 20. Drawing 1 is explanatory drawing which expresses the cross section of this single cell 20 typically. The single cell 20 which is the base unit of a fuel cell 10 consists of an electrolyte layer 21, the anode 22 and the cathode 23, and separators 24 and 25.

[0033] The anode 22 and the cathode 23 are gas diffusion electrodes which constitute a sandwich structure on both sides of the electrolyte layer 21 from both sides. Separators 24 and 25 form the passage of fuel gas and oxidization gas between the anode 22 and the cathode 23, sandwiching this sandwich structure from both sides further. Fuel gas passage 24P are formed between the anode 22 and the separator 24, and oxidization gas-passageway 25P are formed between the cathode 23 and the separator 25. Although separators 24 and 25 form passage only in one side in drawing 1, respectively, the rib is formed in the both sides in fact, one side forms fuel gas passage 24P between anodes 22, and other sides form oxidization gas-passageway 25P between the cathodes 23 with which the adjoining single cell is equipped. Thus, separators 24 and 25 have played the role which separates flowing of fuel gas and oxidization gas between the adjoining single cells while they form a gas passageway between gas diffusion electrodes. The rib is formed only in one side to which the separator of two sheets located in the ends of stack structure touches a gas diffusion electrode, in case the laminating of the single cell 20 is carried out and stack structure is formed from the first.

[0034] Here, the electrolyte layer 21 is the ion exchange membrane of proton conductivity formed by solid-state polymeric materials, for example, a fluorine system resin, and shows good electrical conductivity according to a damp or wet condition. The Nafion layer (Du Pont make) was used in this example. The alloy which consists of the platinum as a catalyst or platinum, and other metals is applied to the front face of the electrolyte layer 21. As the technique of applying a catalyst, the suitable organic solvent is made to distribute the carbon powder which supported this catalyst, optimum-dose addition of the electrolytic solution is carried out, it is pasted [ the carbon powder which supported the alloy which consists of platinum or platinum, and other metals is produced, ], and the technique of screen-stenciling on the electrolyte layer 21 is taken.

[0035] The carbon powder which supported the platinum catalyst is produced by the following technique. First, mixing the chloroplatinic-acid aqueous solution and a sodium thiosulfate, obtaining the aqueous solution of a sulfurous-acid platinum complex, and stirring this aqueous solution, hydrogen peroxide solution is dropped and the platinum grain of colloid is made to separate in the aqueous solution. next, carbon black [(trademark of U.S. CABOT), Vulcan XC-72 [ for example, ], and the DIN which become this aqueous solution with support -- a turnip -- adding rack (trademark of DENKI KAGAKU KOGYO K.K.)], it stirs and the platinum grain of colloid is made to adhere on the surface of carbon black And after separating the carbon black to which platinum grain adhered by suction filtration or pressure filtration out of the aqueous solution and washing by demineralized water repeatedly, it is made to dry completely at a room temperature. Next, a grinder grinds the carbon black condensed at the process of this xeransis, while it heats about 2 hours at 250 degrees C - 350 degrees C and the platinum on carbon black is returned in the hydrogen-reduction ambient atmosphere, remaining chlorine is removed completely and the carbon powder which supported the platinum catalyst is completed.

[0036] The support density (proportion of the weight of the platinum on the carbon to the weight of carbon) of the platinum to carbon black can be adjusted by changing the proportion of the amount of a chloroplatinic acid, and the amount of carbon black, and can obtain the platinum catalyst of arbitrary support densities. In addition, as long as the manufacture technique of a platinum catalyst is technique by which not only the above-mentioned technique but sufficient catalytic activity is obtained, you may manufacture it by other technique.

[0037] Although the above explanation described the case where platinum was used as a catalyst, the alloy catalyst which consists of an alloy with one kind or two kinds or more of components of inside, such as the platinum which is the 1st component, the ruthenium which is the 2nd component, nickel, cobalt, an indium, iron, chromium, and manganese, can also be used.

[0038] Both the anode 22 and the cathode 23 are formed of the carbon cross woven with the yarn which consists of a carbon fiber. In addition, in this example, although the anode 22 and the cathode 23 were formed by the carbon cross, the configuration formed by the carbon paper or carbon felt which consists of a carbon fiber is also suitable.

[0039] The above-mentioned electrolyte layer 21, the anode 22, and the cathode 23 are unified by thermocompression bonding. That is, the electrolyte layer 21 which applied the catalyst of platinum etc. is pinched with the anode 22 and the cathode 23, and these are stuck by pressure, heating at 120-130 degrees C. As the technique of unifying the electrolyte layer 21, the anode 22, and the cathode 23, you may use the technique [ are based on thermocompression bonding, and also ] by adhesion. If between each electrode and the electrolyte layers 21 is joined using a proton conductivity solid-state macromolecule solution (for example, Aldrich Chemical, Nafion Solution) in case the electrolyte layer 21 is pinched with the

anode 22 and the cathode 23, it works as adhesives in the process which a proton conductivity solid-state macromolecule solution solidifies, and each electrode and the electrolyte layer 21 fix.

[0040] Separators 24 and 25 are formed by the conductive gas non-penetrated member, for example, the substantia-compacta carbon which compressed carbon and it presupposed gas un-penetrating. Separators 24 and 25 form in the both sides two or more ribs arranged in parallel, and as mentioned already, fuel gas passage 24P are formed on the front face of an anode 22, and they form oxidization gas-passageway 25P on the front face of the cathode 23 of the adjoining single cell. Here, the rib formed in the front face of each separator is good also as making a predetermined angle -- it is not necessary to form both sides in parallel, and they go direct for every field. Moreover, it does not need to have the shape of a parallel slot, and if supply of fuel gas or oxidization gas is possible for the configuration of a rib to the gas diffusion electrode, it is good.

[0041] In the above, the configuration of the single cell 20 which is the basic structure of a fuel cell 10 was explained. When actually assembling as a fuel cell 10, the group laminating of two or more a separator 24, the anode 22, electrolyte layers 21, cathodes 23, and separators 25 is carried out in this sequence (this example 100 sets), and stack structure is constituted by arranging the current collection plates 26 and 27 formed in the ends with substantia-compacta carbon, a copper plate, etc.

[0042] Next, the connection of separators 24 and 25 and the electrolyte layer 21 is explained. The configuration of this connection corresponds to the principal part of this invention. Drawing 2 is sectional drawing of the edge of the single cell 20, and shows the configuration of a connection. The connection between the electrolyte layer 21 and the separators 24 and 25 is made using adhesives. The electrolyte layer 21 forms ion-exchange section 21a in the circumference section equivalent to the connection with separators 24 and 25. This ion-exchange section 21a has lost absorptivity by giving the ion exchange treatment mentioned later. In separators 24 and 25, if the single cell 20 is assembled after applying adhesives to the field corresponding to a connection, as shown in drawing 2, ion-exchange section 21a will be covered, the adhesives layer 29 will be formed, and a connection will be completed.

[0043] The ion exchange treatment to the electrolyte layer 21 is explained below. As shown in drawing 2, the electrolyte layer 21 is the circumference of cell right-hand-side 21b which is inserted into the anode 22 and the cathode 23, and participates in a cell reaction, and cell right-hand-side 21b, and can be divided into the field without regards to a cell reaction. An ion exchange treatment is performed to this circumference field, and it makes with ion-exchange section 21a. First, the electrolyte layer 21 is equipped with the masking implement 30 shown in drawing 3. The status that drawing 3 (a) equipped the electrolyte layer 21 with the masking implement 30, and saw it from width is shown, and drawing 3 (b) shows the status that it saw from the top. For this masking implement 30, when it has the masking section 32 and the electrolyte layer 21 is equipped, the masking section 32 is a wrap about cell right-hand-side 21b.

[0044] The masking implement 30 which pinches the electrolyte layer 21 equips the periphery with the conclusion bolt 34, and the masking section 32 can be stuck on the electrolyte layer 21 by binding the conclusion bolt 34 tight. The pressure to which the masking implement 30 pinches the electrolyte layer 21 in the masking section 32 should just be a pressure exceeding the osmotic pressure in the electrolyte layer 21 that what is necessary is just to be able to prevent inactivating cell right-hand-side 21b in next inactivation processing. At this example, it is 250kg/cm. The electrolyte layer 21 was pinched by the pressure. Moreover, the thing made from stainless steel was used for the masking implement 30 at this time.

[0045] Next, it floods with the potassium-hydroxide solution of 1 convention (it is written as henceforth 1N) of the electrolyte layer 21 pinched by the masking implement 30, and an ion exchange treatment is performed. Conductivity is shown by having the structure shown in drawing 4, the proton of functional-group A separating at the time of an operation of a cell, and the electrolyte layer 21 moving with a moisture child. If this electrolyte layer 21 is flooded with the above-mentioned potassium-hydroxide solution, as shown in drawing 5, the ion exchange reaction that the proton of a functional group replaces potassium ion will happen, and the structure of functional-group A of the electrolyte layer 21 will change. At this time, since sufficient pressure is put on cell right-hand-side 21b covered by the masking implement 30 to have mentioned above, potassium ion does not permeate and an ion exchange reaction does not occur. Therefore, ion-exchange section 21a is formed in the field in which the ion exchange reaction happened only on the outside of cell right-hand-side 21b, and this ion exchange reaction happened. In the field in which such an ion exchange reaction occurred, since the proton which separates and attracts a moisture child replaces potassium ion, absorptivity is lost.

[0046] After that, the electrolyte layer 21 is dried after an ion exchange treatment (100 degrees C, 20min.), it screen-stencils to cell right-hand-side 21b, and as mentioned above, the catalyst of platinum etc. is applied. The electrolyte layer 21 which fixed the catalyst is pinched with the anode 22 and the cathode 23 which are a gas diffusion electrode, and fixes these by thermocompression bonding. Although this gas diffusion electrode is further pinched with separators 24 and 25 from an outside, between ion-exchange section 21a protruded from the gas diffusion electrode in the electrolyte layer 21 and the separators 24 and 25 is connected with adhesives in that case. In ion-exchange section 21a inactivated by the ion exchange treatment mentioned above, since absorptivity is lost, sufficient seal nature is realizable with adhesives. Even if cell right-hand-side 21b with absorptivity will be in a damp or wet condition, in order that ion-exchange section 21a may not absorb water, an adhesive property does not fall gradually at the time of a cell operation. Here, adhesives used the thing of an epoxy system. Thus, the laminating of the constituted single cell 20 is carried out, and a fuel cell 10 is completed.

[0047] In the fuel cell 10 of this example constituted as mentioned above, the adhesive property with adhesives is secured by preparing ion-exchange section 21a which lost absorptivity on the electrolyte layer 21, and the gas seal in each \*\* cell 20 is performed using adhesives. Therefore, the outstanding effect that the area of the electrolyte layer which does not need to prepare a special member like an O ring for a gas seal, and is needed can also be stopped to the minimum extent is done so.



Thin shape-ization of the fuel cell 10 whole which thin shape-ization of the single cell 20 is not obstructed and furthermore carried out the laminating of the single cell 20 by the fuel cell 10 of this example since another member which has predetermined thickness like an O ring was not put also becomes possible. Moreover, since thin shape-ization of the single cell 20 can increase the number of sheets of the single cell 20 which carries out a laminating, the capacity of a fuel cell 10 can be made to increase.

[0048] What is necessary is to be formed with the stable quality of the material to the solution for the ion exchanges, such as a potassium hydroxide, and just to have the intensity which pinches the electrolyte layer 21 by sufficient pressure in this example, although the masking implement 30 used the thing made from stainless steel. For example, it is good also as metal, such as the aluminum and iron which were plated with gold or platinum, and copper, and you may form by resins, such as an acrylic and chloroethylene.

[0049] Although considered as the configuration which gives an ion exchange treatment to the circumference section without regards to the cell reaction in the electrolyte layer 21 in the 1st above-mentioned example, an ion exchange treatment is first performed to the electrolyte layer 21 whole, and it is good after that also as a configuration made to recover the electrolyte layer activity of cell right-hand-side 21b. It explains below, using such a configuration as the 2nd example.

[0050] Here, electrolyte layer 21B is first flooded with the potassium-hydroxide solution of 1N, and an ion exchange treatment is performed to the whole electrolyte layer 21B. After an ion exchange treatment dries electrolyte layer 21B like the 1st example, and makes the front face fix the catalyst of platinum etc. by screen-stencil. Then, electrolyte layer 21B is equipped with the masking implement 40 shown in drawing 6, and processing which revives electrolyte layer activity is performed. The masking implement 40 is equipped with the wrap masking section 42 for the circumference section except cell right-hand-side 21Bb conversely [ the masking implement 30 ]. The circumference field covered by the masking section 42 maintains the status that the ion exchange was carried out with potassium ion, without changing also with 50kg[cm J2) and above-mentioned processings at (this example by the ability of a predetermined pressure being applied, and forms ion-exchange section 21Ba. processing which revives electrolyte layer activity \*\*\*\*\* -- first -- the sulfuric acid of 1N -- 2 hours -- boiling -- a proton -- the cation for which it was exchanged by boiling in the rich status is driven out of a functional group Boiling washing is carried out by the ion exchange water after that (2 hour x2-3 time). By this, cell right-hand-side 21Bb which is not covered with the masking implement 40 returns to the structure shown in drawing 4, and electrolyte activity revitalizes it.

[0051] Although this electrolyte layer 21 is assembled like the 1st example and fuel cell 10B is constituted, the gas seal in each \*\* cell is performed by adhesives like the 1st example.

[0052] Thus, in addition to the effect of the fuel cell 10 of the 1st example, in fuel cell 10B of the 2nd constituted example, the effect that fixing of the catalyst by screen-stencil becomes simple is done so. It is in the status that the ion exchange of the cell right-hand-side 21Bb which a catalyst fixes is carried out, and absorptivity was lost at the time of screen-stencil, in the 2nd example. Therefore, the solvent used for screen-stencil is absorbed, an electrolyte layer does not swell, and printing of a catalyst becomes simple.

[0053] Although the gas seal in the single cell circumference section was performed in the above 1st and the 2nd example using adhesives, the configuration which performs a gas seal by thermocompression bonding is also desirable. If an ion ~~exchange-treatment~~ is performed as mentioned above to a solid-state polyelectrolyte layer, although it will lose absorptivity and the adhesive property by adhesives will improve, a solid-state polyelectrolyte layer also acquires the thermoplastic by the ion exchange treatment, and it is enabled to realize sufficient gas seal by thermocompression bonding. The configuration which performs such a gas seal by thermocompression bonding is shown below as the 3rd example.

[0054] When a gas seal is performed and it manufactures fuel cell 10C by thermocompression bonding, the manufacturing process of electrolyte layer 21C is the same as that of the above 1st or the 2nd example. That is, according to the technique of the 1st or 2nd example, an ion exchange treatment is performed to the circumference section except cell right-hand-side 21Cb, ion-exchange section 21calcium is formed, and the catalyst of platinum etc. is fixed in cell right-hand-side 21Cb. Although this electrolyte layer 21C is pinched by the gas diffusion electrode of a couple, thermocompression bonding is performed and these are further pinched with separators 24C and 25C, separators 24C and 25C are beforehand heated at 200 degrees C in that case. Thus, the junction to electrolyte layer 21C can be performed by heating separators 24C and 25C beforehand at an instant. If separators 24C and 25C are heated as mentioned above more than the melting temperature of an electrolyte layer, electrolyte layer 21C in contact with this will be melted on that spot. When this electrolyte layer 21C got cold and solidifies in the status that it connected with separators 24C and 25C, sufficient gas-seal nature is attained.

[0055] Here, as for the connection grade of separators 24C and 25C, split-face-izing beforehand is desirable. Although the technique of split-face-izing has technique, such as shaving off with the technique by sputtering and laser of an argon, or the file with fine scale division, it just split-face-izes moderately connection grade of separators 24C and 25C. If connection grade of separators 24C and 25C is split-face-ized beforehand and the split-face-ized sections 24a and 25a which have the fine concavo-convex section are formed in the front face Since this melted electrolyte layer 21C enters into the concavo-convex section with the fine split-face-ized sections 24a and 25a when ion-exchange section 21calcium of electrolyte layer 21C is heated and melts, connection between separators 24C and 25C and electrolyte layer 21C can be strengthened more. A mode that electrolyte layer 21C and the separators 24C and 25C were connected by thermocompression bonding is shown in drawing 7.

[0056] Thus, if thermocompression bonding performs the gas seal between ion-exchange section 21calcium of electrolyte



layer 21C, and the separators 24C and 25C, it is not necessary to prepare a special member like an O ring for a gas seal and, and the outstanding effect that the area of electrolyte layer 21C can be stopped to the minimum extent will be done so. Since another member which has predetermined thickness still like [ in fuel cell 10C of this example ] an O ring is not put, thin shape-ization of whole fuel cell 10C which did not obstruct thin shape-ization of single cell 20C and carried out the laminating of single cell 20C also becomes possible. Moreover, since thin shape-ization of single cell 20C can increase the number of sheets of single cell 20C which carries out a laminating, the capacity of fuel cell 10C can be made to increase. [0057] In this example, separators 24C and 25C are beforehand heated more than the melting temperature of electrolyte layer 21C, and thermocompression bonding was performed between electrolyte layer 21C. Although it is possible for you to also make it heated and stuck by pressure after not performing such a preheating to separators 24C and 25C but pinching gas diffusion electrodes 23C and 24C with separators 24 and 25, electrolyte layer 21C can mitigate the damage received with heat by heating separators 24 and 25 beforehand. If electrolyte layer 21C heat-treats at about 200 degrees C by some material, a membranous property will change, a hydrophobic property will become strong, and that to which conductivity falls is known. In heating after pinching with separators 24C and 25C, while carrying out melting of the ion-exchange section 21Ca, cell right-hand-side 21Cb will also be much exposed to the same elevated temperature. If separators 24C and 25C are preheated, since operation of thermocompression bonding will be completed like this example for a short time, cell right-hand-side 21Cb can shorten the time exposed to an elevated temperature, and can mitigate the damage received at an elevated temperature. From the first, when electrolyte layer 21C is within the limits which can permit the damage received with heat, the preheating of separators 24 and 25 is not performed and it does not matter as a configuration which heats the whole at the time of sticking by pressure.

[0058] There is no above 1st, although the electrolyte layer with a thickness of 100 micrometers was used for the 3rd example, thin shape-ization of an electrolyte layer brings conductive enhancement and its cell performance of each \*\* cell improves by this. In the solid-state polyelectrolyte type fuel cell, since when ion moves in the inside of the electrolyte layer which is a solid-state shows conductivity, in order for the one where an electrolyte layer is thinner to secure such conductivity, it is suitable. The case where thermocompression bonding performs a gas seal to below using an electrolyte layer with a thickness of 50 micrometers is explained as the 4th example.

[0059] As well as the 1st or 3rd example when using a thin electrolyte layer, an ion exchange treatment can be given to the circumference section, and the thermoplastic can be given. However, in the case of an electrolyte layer thin in this way, when it is going to perform thermocompression bonding like the 3rd example, since a thickness is too thin, an electrolyte layer may be damaged. Or when not damaged at the time of thermocompression bonding, it is damaged by continuing applying a big pressure on stream [ a fuel cell ], and the shunt may be caused. Then, in this example, in order for thermocompression bonding to perform a gas seal in this way using the electrolyte layer of an about 50-micrometer thin thickness, the \*\* material 28 of the same material as the electrolyte layer which gave the ion exchange treatment was used. As shown in drawing 8, ion-exchange section 21Da of electrolyte layer 21D is pinched to the character type of \*\* by such \*\* material 28, and thermocompression bonding is performed among separators 24D and 25D.

[0060] You may produce electrolyte layer 21D by which technique of the 1st example or the 2nd example in that case. It is good also as covering cell right-hand-side 21Db, performing an ion exchange treatment only to the circumference section, and making after that cell right-hand-side 21Db fix a catalyst, and after carrying out the ion exchange treatment of the whole electrolyte layer 21D and making cell right-hand-side 21Db fix a catalyst, it is good also as restoring the electrolyte activity of cell right-hand-side 21Db. As \*\* material 28 used when performing thermocompression bonding, the same solid-state polyelectrolyte layer as electrolyte layer 21D is prepared, and the same ion exchange treatment as electrolyte layer 21D is given to this solid-state polyelectrolyte layer. Consequently, ion-exchange section 21Da of electrolyte layer 21D and \*\* material 28D will be equipped with the thermoplastic. Electrolyte layer 21D is pinched by the gas diffusion electrodes 22D and 23D of a couple, thermocompression bonding of these is carried out, and as shown in drawing 8, the \*\* material 28 is arranged to the character type of \*\* at ion-exchange section 21Da protruded from these gas diffusion electrodes 22D and 23D. Seal nature can be attained between electrolyte layer 21D and the separators 24D and 25D by pinching and pressurizing these with the separators 24D and 25D beforehand heated at 200 degrees C. It is desirable to split-face-ize the jointing of separators 24D and 25D beforehand like the 3rd example.

[0061] According to the fuel cell of the 4th example, in order to make the \*\* material 28 intervene between electrolyte layer 21D and the separators 24D and 25D, even if it performs thermocompression bonding using thin electrolyte layer 21D of a thickness, electrolyte layer 21D is not damaged by putting a pressure. Moreover, when operating this fuel cell, by binding tight by the high pressure, electrolyte layer 21D is damaged and there is also no possibility of causing the shunt. Here, in order to carry out the ion exchange of the same solid-state polyelectrolyte layer as electrolyte layer 21D and to use it as \*\* material 28, the \*\* material 28 shows the good thermoplastic like electrolyte layer 21D, and it connects electrolyte layer 21D and the separators 24D and 25D, realizing sufficient seal nature. Since electrolyte layer 21D and the \*\* material 28 are the same materials, it is good, and at the time of thermocompression bonding, the concordance between both members carries out melting, unifies easily, and shows the outstanding adhesive property.

[0062] Moreover, although the thickness of an electrolyte layer was set to 50 micrometers in the fuel cell of this example, a thickness is not restricted to 50 micrometers. In case it carries out thermocompression bonding of the thin electrolyte layer with the weak intensity to a pressure, the method of making the \*\* material 28 intervene like this example is effective in order to prevent trauma of an electrolyte layer.

[0063] Although the solid-state polyelectrolyte layer of the same material as electrolyte layer 21D was used as \*\* material 28 used in the case of thermocompression bonding here By thermocompression bonding, the \*\* material 28 maintains seal nature for between electrolyte layer 21D and the separators 24D and 25D, and has the thermoplastic which can be pasted up. What is necessary is just to be able to prepare the thickness which realizes the intensity which can prevent fracture and the shunt of electrolyte layer 21D between electrolyte layer 21D and the separators 24D and 25D. For example, waterproof steam nature, oxidation resistance, and thermoplastic temperature are able to use electrolyte layer 21D and a near thing as \*\* material 28 like polyethylene, polypropylene, and the polycarbonate. It is not necessary to prepare for \*\* material the thing for which teaching materials 28 are formed with these quality of the materials, then a special solid-state polyelectrolyte layer.

[0064] At the time of an ion exchange treatment although [ the above 1st or the 4th example / an electrolyte layer ] flooded with the potassium-hydroxide solution of 1N, this ion-exchange liquid should just contain the cation of the amount which can replace the proton of functional-group A of an electrolyte layer completely. Therefore, a proton can fully be replaced by making concentration of ion-exchange liquid deeper than this reducing volume conversely that there should just be sufficient volume even if it is a low-concentration alkali solution.

[0065] Moreover, besides a potassium hydroxide, the proton and the ion exchange of functional-group A of an electrolyte layer are possible for a sodium hydroxide, tetrapod butyl ammonium (TBA), etc., and the solution used for the ion exchange makes the absorptivity of an electrolyte layer lose according to the ion exchange, or should just give the thermoplastic. A potassium-hydroxide solution and a sodium-hydroxide solution are the ion-exchange liquid which can end an ion exchange treatment for a short time, and, as for these, the capacity to make absorptivity lose and to give the thermoplastic is also enough. Although the ion exchange takes time compared with a potassium-hydroxide solution or a sodium-hydroxide solution, tetrapod butyl ammonium can perform a hydrophobing and heat plasticization more completely compared with potassium ion or sodium ion, since the connection with functional-group A is strong, once the ion exchange is performed.

[0066] As mentioned above, an electrolyte layer is made to be equipped with a hydrophobic property and the thermoplastic by giving an ion exchange treatment to an electrolyte layer, and although the configuration which makes possible the adhesion and thermocompression bonding by adhesives was explained, originally the electrolyte layer takes on the property of these hydrophobic properties or the thermoplastic by the precursor layer. The configuration which performs a gas seal between separators using the property of this precursor layer is explained as the 5th example below.

[0067] Although the solid-state polyelectrolyte layer used in the example explained until now takes the structure shown in drawing 4 as mentioned already, the precursor layer of this solid-state polyelectrolyte layer has the structure shown in drawing 9. The fluorine has combined the precursor layer instead of the proton of functional-group A, and this structure is the inactive structure without the separating ion, and a precursor layer does not have absorptivity like the layer which carried out the ion exchange, but is equipped with the thermoplastic. Usually, although a fuel cell is manufactured, using as a material the solid-state polyelectrolyte layer which performed predetermined activation processing to this precursor layer, in this example, a precursor layer before performing activation processing is used as a material. The precursor layer which has the structure shown in drawing 9 will be henceforth called female mold layer.

[0068] First, the prepared female mold layer is equipped with the masking implement 40 shown in drawing 6 like the 2nd example. By equipping with the masking implement 40, the circumference section except cell right-hand-side 21b will be covered. Activation processing is performed to electrolyte layer 21E in this status. By performing the following activation processings in the status that it equipped with the masking implement 40, only cell right-hand-side 21Eb is activated, and the circumference section of cell right-hand-side 21Eb remains as female mold section 21c, without being activated. As activation processing, first, boiling is performed in the potassium-hydroxide solution of 1N for 2 hours, and the fluorine of functional-group A is transposed to a potassium. Next, similarly boiling is performed in the sulfuric acid of 1N for 2 hours, potassium ion is transposed to a proton and boiling washing is performed 2 to 3 times in an ion exchange water after that. By this processing [ a series of ], a female mold layer turns into the Nafion layer of the structure which it is activated and is shown in drawing 4, and electrolyte layer 21E is done.

[0069] Back electrolyte layer 21E of the above-mentioned processing is dried (100 degrees C, 20min.), and a catalyst is made to fix by screen-stencil as stated above to cell right-hand-side 21Eb like the 1st example. After that, this electrolyte layer 21E is pinched by the gas diffusion electrodes 22E and 23E of a couple, these are further pinched with separators 24E and 25E, and between electrolyte layer 21E and the separators 24E and 25E is pasted up using adhesives. Thus, single cell 20E shown in drawing 2 is constituted, the laminating of this single cell 20E is carried out, and fuel cell 10E is produced.

[0070] In the fuel cell of the 5th example explained above, since the circumference section forms the female mold section holding the property of a precursor layer in response to activation processing, only cell right-hand-side 21Eb can perform the gas seal of each \*\* cell 20E using adhesives using the female mold section without absorptivity. Therefore, it is not necessary to prepare another member like an O ring for a gas seal, therefore the area of required electrolyte layer 21E can be stopped to the minimum extent. Moreover, since it is not necessary to incorporate the O ring with the predetermined thickness of about 2mm, it is enabled to be able to attain thin shape-ization of the whole fuel cell 10E, to increase the number of single cells which carries out a laminating, and to increase cell capacity.

[0071] In the 5th above-mentioned example, although the catalyst of platinum etc. was fixed by screen-stencil after performing activation processing to cell right-hand-side 21Eb, before performing activation processing, you may perform such fixing of a catalyst. That is, it screen-stencils in the status of the female mold before activation processing, a catalyst is fixed, and activation processing which equipped with and described the masking implement 40 above after that is performed.

Thus, since it is the female mold with which electrolyte layer 21F do not have absorptivity at the time of fixing of a catalyst when producing fuel cell 10F, it can screen-stencil simpler by electrolyte layer 21F not swelling by the solvent used for screen-stencil.

[0072] Moreover, although adhesives performed the gas seal in each \*\* cell 20 in the 5th above-mentioned example, it is good also as carrying out by thermocompression bonding like the 3rd example. Since a female mold layer is equipped with the thermoplastic as well as the case where an ion exchange treatment is performed, it can perform a gas seal by thermocompression bonding. In this case, the catalyst of activation processing of a precursor layer, platinum, etc. is first fixed as well as the 5th example. Although it does not matter even if it carries out behind even if it performs fixing of the catalyst by screen-stencil before activation processing of a precursor layer, as mentioned above, there is an advantage that fixing of a catalyst becomes [ the direction which screen-stenciled to the female mold layer without absorptivity ] simple. Processing of subsequent thermocompression bonding is common in the 3rd example. Adhesion at the time of thermocompression bonding can be more strengthened by split-face-izing the connection of separators 24G and 25G beforehand. Moreover, separators 24G and 25G are beforehand heated at 200 degrees C, and it can prevent electrolyte layer 21G being spoiled by high temperature by ending thermocompression bonding for a short time.

[0073] thus, the thing for which a female mold layer has the thermoplastic -- using -- thermocompression bonding -- each -- it is not necessary to prepare another member like an O ring for a gas seal, and a required area can be stopped to the minimum extent as electrolyte layer 21G like the fuel cell of the 5th example in the fuel cell which performed the gas seal of \*\* cell 20G. Moreover, thin shape-ization of the whole fuel cell of the O ring which has predetermined thickness is attained by becoming unnecessary. Furthermore, since the number of the single cells which carry out a laminating by the same volume can be increased, it is enabled to raise a cell performance.

[0074] Here, when a catalyst is beforehand fixed in the state of a female mold layer and it carries out activation processing of the after that cell right-hand-side 21Gb, the process of the xeransis after activation processing can be omitted and thermocompression bonding can be performed. When drying a thin electrolyte layer, in order to prevent a wrinkling arising on an electrolyte layer at the process of xeransis, it is necessary to insert an electrolyte layer with a tabular instrument and to make it dry, where an electrolyte layer is lengthened. Like [ in above-mentioned ], when the catalyst has already fixed at the time of activation processing, such a process that dries an electrolyte layer can be omitted, and where an electrolyte layer is lengthened, it can dry simultaneously by performing thermocompression bonding.

[0075] Furthermore, when a thickness performs a gas seal by about 50 micrometers and the fuel cell using thin electrolyte layer 21H, the property of a female mold layer can be used. In this case, in order to prevent fracturing in case a thin electrolyte layer is thermocompression bonding, the intensity which allots \*\* material 28H to the connection with separators 24H and 25H, compensates the thickness of electrolyte layer 21H like the configuration shown in drawing 8 in the 4th example, and is equal to sticking by pressure is given.

[0076] At this time, electrolyte layer 21H are prepared in the state of a female mold layer as well as the 5th example, equip this with the masking implement 40 shown in drawing 6, and perform activation processing of cell right-hand-side 21Hb. The catalyst of platinum etc. is fixed in cell right-hand-side 21Hb by the screen-stencil behind mentioned already before performing activation processing of cell right-hand-side 21Hb in that case. In electrolyte layer 21H, since it was covered by the masking implement 40, it is not activated, but the circumference section except cell right-hand-side 21Hb which received activation processing forms female mold section 21Hc which has the thermoplastic. This female mold section 21Hc is inserted into the character type of \*\* by \*\* material 28H which is similarly a female mold layer, as shown in drawing 8, the gas diffusion electrodes 22H and 23H and the separators 24H and 25H of a couple are allotted, and thermocompression bonding is performed. If separators 24H and 25H are beforehand heated at 200 degrees C and sticking by pressure is ended for a short time at this time, it can stop that electrolyte layer 21H receive a damage at an elevated temperature.

[0077] When thermocompression bonding was performed as mentioned above and the separators 24H and 25H which it preheated are contacted, female mold section 21Hc of electrolyte layer 21H and \*\* material 28H melt, and between electrolyte layer 21H and the separators 24H and 25H is pasted up without an opening in the process in which these get cold and solidify. Here, an electrolyte is not damaged, even if it pressurizes for adhesion, since predetermined thick \*\*\*\*\* material 28H intervenes between electrolyte layer 21H and the separators 24H and 25H. moreover, it produced in this way -- single -- in the fuel cell which carried out the laminating of cell 20H, even if it operates in the status that bound stack structure tight and it always pressurized, electrolyte layer 21H are damaged on stream, and the shunt is not caused

[0078] Here, as \*\* material 28H which connects female mold section 21Hc and the separators 24H and 25H, since the female mold layer of the fluorine system resin of the same material as electrolyte layer 21H was used, it is good, and at the time of heating, both do melting, and the concordance of electrolyte layer 21H and \*\* material 28H unifies easily, and shows a strong adhesive property. It has sufficient thickness for the layer used as this \*\* material 28H to compensate the intensity in the sticking-by-pressure section of electrolyte layer 21H, and as long as it has the thermoplastic which carries out the gas seal of between electrolyte layer 21H and the separators 24H and 25H by thermocompression bonding, you may use the layer of other type. Instead of a female mold layer, the layer which gave the above-mentioned ion exchange treatment may be used, and waterproof steam nature, oxidation resistance, and thermoplastic temperature can also use electrolyte layer 21H and a near layer like polyethylene, polypropylene, and polycarbonate.

[0079] In the example explained above, after making carbon powder support, the suitable organic solvent was distributed, and the catalyst of platinum etc. carried out optimum-dose addition of the electrolytic solution, pasted it, and fixed on the

electrolyte layer 21 by screen-stencil. Thus, according to the technique of fixing a catalyst by printing on a flat electrolyte layer, since a catalyst fixes uniformly, catalytic activity can fully be used at the time of an operation of a cell, and there are also few amounts of catalysts which fix and they end. If it considers as the technique of fixing a catalyst on the electrolyte layer 21, it is good also as making platinum support with the thin film forming methods, such as a spatter, a vacuum deposition, CVD, and PVD. Moreover, the electrolyte layer 21 cannot be made to be able to fix but the catalyst of platinum etc. can also be fixed in a gas-diffusion-electrode side. When it fixes a catalyst in the gas diffusion electrode which has irregularity in a front face like a carbon cross, the carbon powder which supported the catalyst of platinum etc. like the case where the above-mentioned screen-stencil is performed can be produced, and a catalyst can be easily fixed by scouring this carbon powder to the electrolyte layer side in a gas diffusion electrode.

[0080] Although the example of this invention was explained above, as for this invention, it is needless to say that it can carry out with the aspect which becomes various within limits which are not limited to such an example at all and do not deviate from the summary of this invention.

---

[Translation done.]